



MEASUREMENT COMPUTATION **news**

product advances from Hewlett-Packard

MAY/JUNE 1984



Measurement-plotting system provides one-stop solution for low-frequency measurement, analysis, and documentation

Hewlett-Packard's new HP 7090A Measurement-Plotting System offers a versatile solution to your measurement needs. By merging several technologies—waveform recording, digital plotting, analog recording, and automated measurement—the HP 7090A provides a powerful solution to a broad range of measurement problems.

With the HP 7090A you can significantly increase your ability to measure and display low-frequency phenomena, while substantially improving your real-time recording and digital plotting results—all with one low-cost system.

Key features

In performing these major functions, the HP 7090A offers the following features:

- **As a low-frequency waveform recorder:** Has three input channels with a 1000-word \times 12-bit buffer and a 33-kilo-samples/s analog-to-digital converter (ADC) on each channel. Sine response is 3 kHz. Multiple triggering modes with pretrigger viewing let you examine transient phenomena. The buffers allow recorded data to be either plotted or previewed with an oscilloscope.

(continued on page 2)

HP offers comprehensive nationwide test system for private voice-frequency telephone circuits

A powerful new modular troubleshooting system from Hewlett-Packard lets you find and diagnose faults in a local or nationwide voice-frequency telephone system from anywhere in the system. The new HP 37100S Remote Access and Test System offers you the freedom to:

- Locate access and test equipment at any suitable points in the system
- Control the complete system from a convenient central site
- Concentrate skilled technicians at a convenient location
- Operate with unmanned offices.

As a result, you can reduce significantly the time spent in fault diagnosis and repair of faulty circuits.

No matter what size your network is, whether it consists of only a few circuits or thousands, an HP 37100S System can be configured to suit your needs. With its flexible modular design, you can fulfill your initial requirements at a minimum cost and expand your network later simply by adding more modules. In addition, HP's system training, support, and software maintenance facilities can help you get the best performance from your HP 37100S System, whatever its size.

Individual circuits can be accessed and tested at remote measurement sites controlled from interactive computer terminals via an HP 1000 A-Series Computer. Many terminals can be added to your system and located wherever you wish: at the central computer site, at remote sites close to the circuits themselves, or at any other suitably equipped site.

Very large systems with many access points can have more than one central site, each with its own computer. These computers can communicate with each other using Hewlett-Packard's Distributed Systems Network, allowing access to any circuit on the network from any terminal.



With the HP 37100S Remote Access and Test System, you can quickly and easily test any circuit on your private voice-frequency telephone network from a central office.

Powerful test features

The comprehensive test features available in an HP 37100S System include the following:

- Dc/ac voltage and current, resistance, and capacitance
- Variable-level and variable-frequency signal source
- Level measurements
- Splitting and termination
- Signaling
- Return loss (including ERL and SRL)
- Peak-to-average ratio (P/AR)
- Control of up to two external instruments at each site.

The HP 37100S System is designed for ease of operation. Its interactive computer terminals guide you through the measurement sequences using prompts and softkey commands, which help you complete your tests with a minimum number of keystrokes. A comprehensive error-checking protocol makes sure that you access the circuit you want. An automatic logging facility records all terminal operations to help you minimize bookkeeping.

System prices vary considerably, depending on the configuration. Consult your HP Sales Rep for component prices. For more information, check **N** on the HP Reply Card.

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May/June 1984

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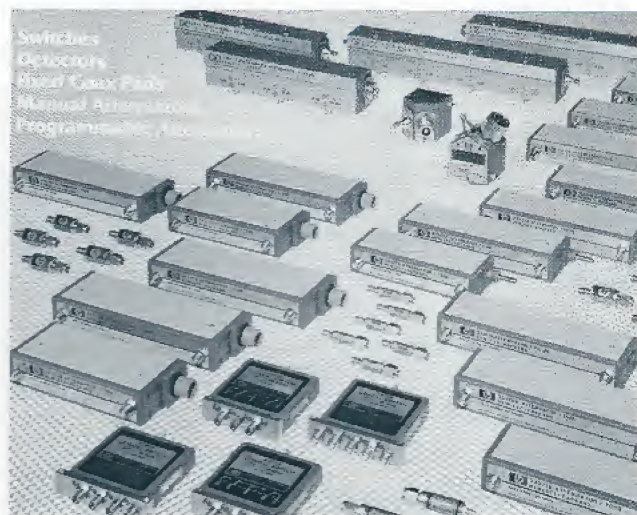
New selection guide describes precision microwave components for OEMs

Hewlett-Packard's microwave instrument designs require the development of a variety of precision passive components, such as step attenuators, coax switches, and the like. HP makes many of these components available for OEM system designers.

A new selection guide now describes this line. 14 manual or programmable coax step attenuators cover from dc to 26.5 GHz and 0 dB to 110 dB. Four versions of coax switches are available: SPDT (18 GHz or 26 GHz), four-port (for microwave matrix switching), and five-port (useful for signal transfer switching). Two broadband detectors can be used for power monitoring, video detection, and leveling for signals to either 18 GHz or 26.5 GHz. Sixteen models of coaxial fixed attenuators cover the range from dc to 26 GHz and 0 to 40 dB.

HP OEM components have been designed and tested for severe environmental conditions, such as operating temperatures from -20°C to $+75^{\circ}\text{C}$, 40°C at 95% RH with condensation, shock, vibration, and varying altitudes.

For your free copy of this guide, check **L** on the HP Reply Card.



Telecommunications Test Equipment

PCM test set simplifies fault diagnosis in mixed analog/digital networks

A one-instrument solution for testing voice and analog data circuits in mixed analog/digital telecommunications networks is now available from Hewlett-Packard. The HP 3776A/B PCM Terminal Test Set, designed primarily for installation, commissioning and acceptance, and maintenance applications, is ideal for testing PCM terminals and channel banks, transmultiplexers, digital switching systems, and mixed analog/digital circuits.

The needs of European (CEPT/CCITT) transmission networks are addressed by the HP 3776A, and the HP 3776B covers North American/Japanese (Bell/CCITT) systems. The HP 3776A measures voice and data impairments in a 4-kHz

analog channel or in any one of the 30 or 31 channels at a 2048-kbit/s PCM interface. The HP 3776B makes similar measurements in the 4-kHz analog channel or in any one of the 24 timeslots at a 1544-kbit/s PCM interface.

Saves costs when testing mixed networks

The HP 3776A/B PCM Terminal Test Set can bring significant savings in two ways:

- **Reduction of test-equipment inventories.** The HP 3776A/B reduces the number of separate instruments—analogue, digital, voice, and data—previously needed in a mixed analog/digital systems environment.
- **Lower maintenance times.** The measurement capability, built-in intelligence, and ease of use of the HP 3776A/B can cut test times and allow easier diagnosis of faults.

Powerful PCM measurement capabilities

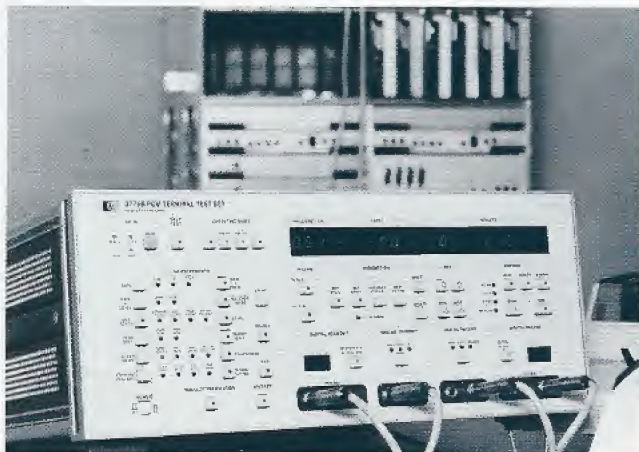
The capabilities of the HP 3776A/B are ideal for a variety of PCM measurement applications:

- **Voice-channel measurements.** Gain, gain tracking, attenuation distortion, nonlinear distortion, and idle-channel noise are among the many measurements available for optimizing voice-channel performance.
- **Data-channel measurements.** The HP 3776A/B offers optional data measurements of envelope (group) delay, phase jitter, and transients.

The HP 3776A/B can output results directly to a printer or plotter via the HP-IB (IEEE 488) interface. The printout of results is neatly tabulated for easy reading and includes measurement parameters. For fast visual identification of problems, results can be presented graphically on a plotter.

The HP 3776A/B is priced at \$11,250.

For more information, check **M** on the HP Reply Card.



You can characterize the voice and data performance of a PCM channel bank using the new HP 3776A/B PCM Terminal Test Set.

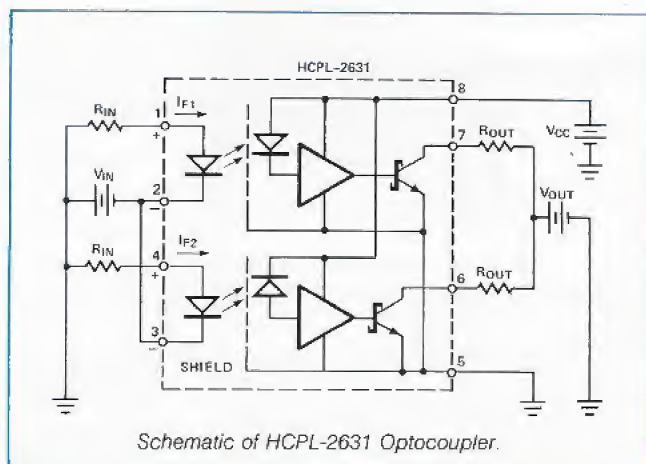
Improve noise immunity, save space with HP's dual-channel optocoupler

The newest member of Hewlett-Packard's broad family of high-performance logic-compatible optocouplers is the HCPL-2631 Optocoupler. The HCPL-2631's dual-channel design in an eight-pin plastic dual in-line package (DIP) saves board space and component cost. It offers 10-Mbaud speed, LSTTL compatibility, and guaranteed common-mode noise immunity.

The HCPL-2631 incorporates a proprietary electric shield that improves immunity to common-mode interference by a 10-to-1 margin over earlier models. The shield results in a guaranteed common-mode noise immunity of $10,000\text{V}/\mu\text{s}$. The 10-Mbaud data rate capability lets you design a high-performance product that easily interfaces with LSTTL and TTL logic. The HCPL-2631 is recognized under the components program of Underwriters Laboratories (File #E55361).

The HCPL-2631 Optocoupler costs \$7.90 in 1000-piece quantities and is available at authorized HP components distributors worldwide.

For more information, check J on the HP Reply Card.



Logic and Processor Based Circuit Analysis

65-channel logic analyzer interfaces with 8-bit and 16-bit microprocessors

The new HP 1630G Logic Analyzer is the highest-performance instrument within Hewlett-Packard's low-priced, general-purpose logic analyzer family. Similar to the HP 1630A and HP 1630D, introduced in January 1983, the HP 1630G provides extended software performance analysis plus state and timing analysis capabilities in one instrument.



The new HP 1630G Logic Analyzer offers software and hardware testing, debugging, and analysis capabilities in a single instrument, including timing, state, and software performance analysis.

In addition to the feature set of the HP 1630A/D, the HP 1630G offers the following features:

- 65 channels, 57 of which are for state analysis; the other eight can be used for either state or timing analysis
- Nonvolatile memory for storing a disassembler and instrument configuration, thus reducing the time needed to set up the instrument
- A time-tagging capability, which allows you to measure the time between each stored state when the HP 1630G is in the state-analysis mode
- A new mass storage device—the HP 9121S/D Single/Dual Flexible Disc Drive—to store the HP 1630G's measurement setups and data quickly and easily
- Full compare mode, which allows you to acquire a full sample of 1,024 states and store it in a reference memory
- HP-IB (IEEE 488) and HP-IL (Hewlett-Packard Interface Loop) capabilities for connecting a variety of peripherals.

Ideal for software and hardware development

The HP 1630G provides designers with a single instrument for both software and hardware testing, debugging, and analysis. The three analysis functions required to develop a digital product—timing, state, and software performance—are now available in this one instrument.

Preprocessors for 8-bit and 16-bit microprocessors

HP provides a variety of preprocessor interface modules that tailor the HP 1630G to specific 8-bit and 16-bit microprocessors, including the 8085, 8086, 8088, 80186, Z80, Z8001, Z8002, 6800/02, 6809/09E, and NSC800. Each interface module comes with a microprocessor inverse assembler.

Price of the HP 1630G Logic Analyzer is \$12,000. The HP 9121S Single Disc Drive is \$900, and the HP 9121D Dual Disc Drive is \$1,270.

For more information, check K on the HP Reply Card.

High-power fiber-optic transmitter offers improved efficiency for LAN and high-speed link applications

Hewlett-Packard's new HFBR-1203/1204 Fiber-Optic Transmitter is designed especially for local area network (LAN) and high-speed computer-link applications in which star-couplers, taps, or in-line splices create large fixed losses or in which long distances are required.

Capable of speeds up to 100 Mbaud, this new transmitter boasts high optical power—typically -7.4 dBm, when coupled into HP's $100/140\text{ }\mu\text{m}$ fiber. This high power results partly from an etched well 820-nm emitter, which provides better thermal conduction. As a result, you can achieve higher efficiency and use higher drive currents to reach longer distances at the same high level of reliability as with other HP fiber-optic products.

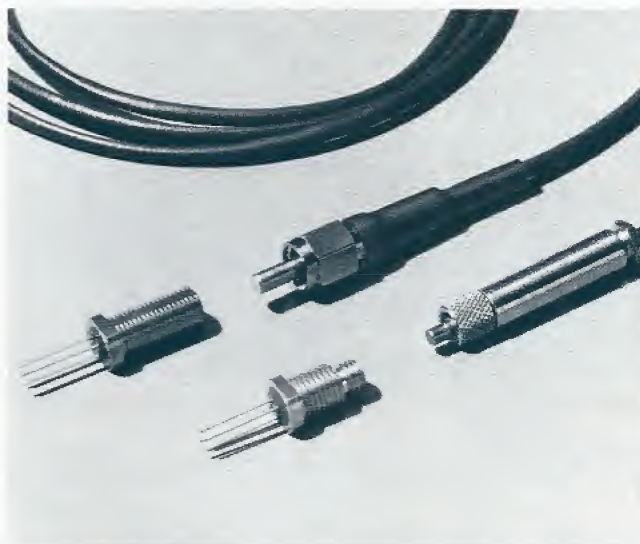
The HFBR-1203/04's precise optical coupling scheme ensures optical power variation of only 5 dB so that the required receiver has a narrower dynamic range.

Another important feature of this new transmitter is its flexibility. Both $100/140\text{ }\mu\text{m}$ and $50/125\text{ }\mu\text{m}$ fibers can be used with it, as well as both SMA- and HP-style connectors. (HFBR-1203 uses HP-style connectors and HFBR-1204 uses SMA-style connectors.)

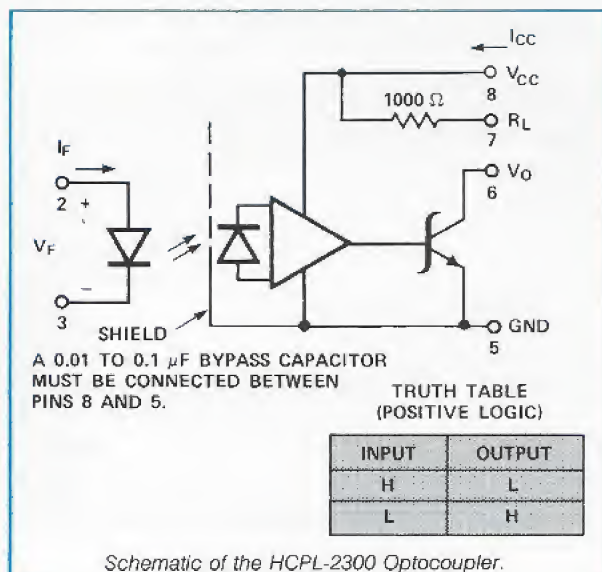
Electrical and optical parameters, including forward voltage and output optical power, are characterized and guaranteed over a temperature range of -40° to $+85^\circ\text{C}$. Because no additional characterization or guard-banding is necessary, the HFBR-1203/04 Transmitter is ideal for high-volume production.

In quantities of 100, the HFBR-1203/1204 Fiber-Optic Transmitters are \$66 each. Both are available through authorized HP components distributors.

For more information, check H on the HP Reply Card.



Low-current, high-speed optocoupler offers CMOS compatibility



Hewlett-Packard's new HCPL-2300 Optocoupler extends the benefits of optical coupling to designs that use CMOS and high data rates and require low power consumption. Packaged in a space-saving eight-pin DIP, the HCPL-2300 offers 5-Mbaud data rates, while requiring only 0.5 mA of LED current. This feature reduces power consumption for the LED drive by a factor of 10 over earlier models and allows direct connection with CMOS logic gates, thereby eliminating the need for high-power buffers, reducing component count, and saving board space.

This new low-current optocoupler combines a diffused-junction 820-nm AlGaAs photon-emitting diode with an integrated high-sensitivity logic gate detector. The low input current and low LED forward voltage (1.3V) provide fast rise and fall times at low drive currents.

A shielded integrated detector circuit results in a guaranteed common mode rejection level of $100\text{V}/\mu\text{s}$. All HCPL-2300 specifications are guaranteed from 0°C to 85°C .

The HCPL-2300 Optocoupler is priced at \$4.50 in 1000-piece quantities and is available from authorized Hewlett-Packard component distributors worldwide.

For more information, check I on the HP Reply Card.

Half-inch tape drive provides high performance and greater reliability at lower cost

Hewlett-Packard's new HP 7978A Half-Inch Magnetic Tape Subsystem costs much less than the HP 7976A but still delivers high performance. With dual-density formats (6250 GCR/1600 PE) and operating at 75 ips in streaming mode, the drive provides the ideal backup solution for systems with greater than 400M bytes of storage. It extends HP's new tape drive product line that began with the midrange HP 7974A introduced in November 1983. The HP 7978A is supported on the HP 3000 Series 39, 40/42, 44/48, and 64/68. Support is planned for the HP 1000 by the fall of 1984.

Greater reliability and reduced cost

This new HP-designed drive offers greatly improved reliability. A simplified mechanical design, coupled with new HP-designed LSI circuitry, results in fewer parts and lower power consumption. Expanded on-board self-tests and diagnostics let you detect and isolate failures from the front panel, resulting in faster repairs and less downtime for your system.



Software provides streaming backup

Newly developed enhancements to the system hardware and software can streamline the communication between the host and tape drive. A new software feature called *Immediate Response* uses a special 32K-byte buffer in the tape drive to stack multiple commands and data blocks. This feature minimizes waiting time for commands or data from the host and allows the drive to stream during backup operations.

The HP 7978A Tape Drive is priced at \$22,000. For more information, check **F** on the HP Reply Card.

New roll-feed and long-axis plotting model and lower prices for HP drafting plotter family

With the introduction of automatic roll-feed and long-axis plotting in the new HP 7586B Plotter, Hewlett-Packard has extended its drafting plotter line to meet a broader range of drafting plotter needs. At the same time, HP has enhanced the capabilities and reduced the prices of its existing family of low-priced drafting plotters.

Handles both cut-sheet and roll media

The new HP 7586B Plotter is designed to handle cut-sheet media from A4 (A size) through A0 (E size) as well as roll media from 10.5 to 36 inches wide and up to 150 feet long. In addition, the HP 7586B can draw frame-to-frame, long-axis

plots up to the length of the roll, or a maximum of 150 feet, by using a technique of plotting a series of 48-inch-long, back-to-back plot segments. A built-in optical sensor enables the plotter to align each subsequent segment to the one plotted previously to produce a continuous plot.

Broad, compatible plotter family

HP's drafting plotter line also includes the HP 7580B Plotter for up to A1 (D size) plots and the HP 7585B for up to A0 (E size) plots for cut-sheet applications and dedicated environments. These plotters have been enhanced with new firmware features to increase plotter intelligence and assure compatibility with the new HP 7586B. All three plotters offer 21 character sets, an 18K-byte partitionable buffer, polygon area-fill instructions, downloadable character sets, and block mode data transfer with the RS-232-C/V.24 interface.

Powerful plotting features

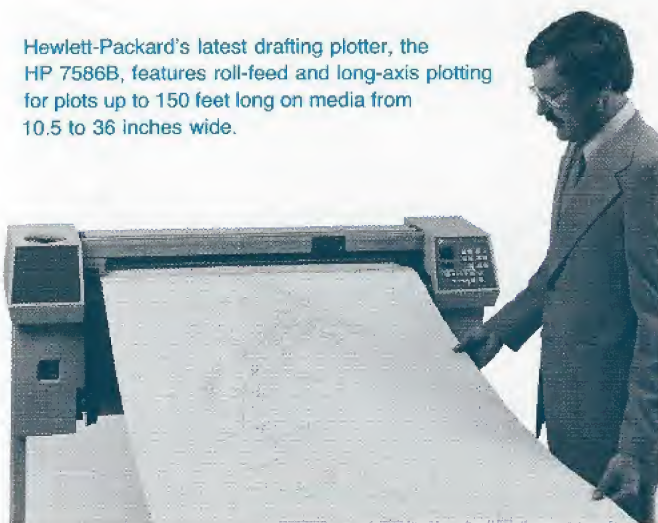
A powerful array of other internal intelligence features relieves the host computer of most computational tasks, reducing your computer overhead. All HP drafting plotters have an addressable resolution of 0.003 mm, resulting in high-quality lines. The 60 cm/s velocity and 4g acceleration of the pens are constant regardless of direction, providing diagonal and axial lines of equal quality.

Three kinds of pens are available—fiber tip, drafting, and rollerball. Pen velocity and force appropriate to each pen type are automatically set by the plotter. When not in use, pens are automatically capped to prevent drying out.

The price of the HP 7586B Plotter is \$21,900. Because of manufacturing cost reductions, the prices of the HP 7580B and HP 7585B Plotters have been reduced from \$16,100 and \$22,900 to \$13,900 and \$16,900, respectively.

For more information, check **G** on the HP Reply Card.

Hewlett-Packard's latest drafting plotter, the HP 7586B, features roll-feed and long-axis plotting for plots up to 150 feet long on media from 10.5 to 36 inches wide.



Test system simplifies and improves signal generator testing

It's easy to verify the performance of signal generators with the new HP 8952S Signal Generator Test System. This powerful test system reduces by several hours the time it takes to test a high-performance signal generator and is easier to use than previous test methods.

Performs complex measurements quickly

Both of the test system's key components, the HP 8902A Measuring Receiver and the HP 8903A Audio Analyzer, are microprocessor-controlled and fully programmable using the HP-IB (IEEE 488) interface. These instruments perform complex measurements quickly and accurately, either manually or directed by an HP Series 200 Computer. Measurements are fully traceable to the U.S. National Bureau of Standards.

In a matter of seconds, the HP 8952S Test System automatically verifies signal generator level accuracy at -127 dBm, a process that used to require several minutes and a collection of equipment. The HP 11795A Software Pac further reduces testing time by checking the signal generator at the critical frequencies and levels required to test all the internal attenuators and output leveling circuitry.

Minimizes measurement errors

Superb measurement accuracy is now possible with the HP 8952S system's high-performance instruments: AM and FM, 1%; level and power, ± 0.02 dB/10 dB. Carrier frequency resolution is 10 Hz. Audio distortion residuals are less than 0.01% (-80 dB).

The HP 8952S also eliminates test procedure errors. The automated HP 11795A's performance verification tests follow each signal generator's performance test procedure.

Price of the HP 8952A Signal Generator Test System is



Save testing time and improve accuracy when testing signal generators with Hewlett-Packard's new HP 8952S Signal Generator Test System.

\$30,562. Optional controllers, printers, and software pacs can be ordered with the test system.

For more information, check **D** on the HP Reply Card.

Q-STAR network integrates production test solutions for product quality and productivity

A significant addition to Hewlett-Packard's Manufacturer's Productivity Network is the HP Q-STAR Network (Quality Systems for Test, Analysis, and Repair). More than just a hardware link, HP Q-STAR offers applications software that lets you use board test data to improve productivity, product quality, and manufacturing processes.

HP Q-STAR takes advantage of the innovative cluster architecture of the HP 3065 Board Test System, allowing access to common peripherals and data bases. Several new application packages enhance the standard HP 3065 software, including paperless repair, test statistics reporting, and interfacing to CAD systems.

Paperless repair and reporting with bar-code capability automate the data flow between test and repair and provide board tracking through the test/repair cycle.

Data obtained in the test and repair loop can now be processed by HP Q-STATS, a standard feature of the HP 3065 which turns data into information required by programmers, test engineers, and managers.

HP CAD-VANTAGE lets you extract data from both custom and commercial computer-aided-design (CAD) systems to be used by the HP 3065. Standard CAD outputs such as net lists and parts lists are read into and reformatted in the test system, instead of depending on CAD-supplied postprocessors.

These new software packages are now standard features of the HP 3065 system except for HP CAD-VANTAGE, which is priced according to the application involved. Contact your HP Sales Rep for details.

For more information, check **E** on the HP Reply Card.



The new HP Q-Star Network offers applications software to help you use board test data for improving productivity and product quality.

New versions of high-performance spectrum analyzers provide greater computing power

The built-in functions of Hewlett-Packard's high-performance spectrum analyzers have been expanded in the new HP 8568B RF (100 Hz to 1500 MHz) and HP 8566B Microwave (100 Hz to 22 GHz) Spectrum Analyzers. These enhancements include new high-level functions to increase measurement capability and develop measurement programs more rapidly.

More than 120 new functions have been added. New signal processing tools such as *PWRBW* (which finds the power bandwidth of a signal) and *PEAKS* (which identifies all responses on the display) allow you to perform arithmetic functions and process measurement data internally without using a computer. New trace processing functions find the rms value of trace data (*RMS*) and multiply two traces point by point (*MPY*). Other new functions process and store trace data in the analyzer's on-board RAM, manipulate trace data to allow simultaneous display of more than one active trace, and perform other tasks required in many spectrum analyzer applications. A set of command flow functions lets you implement your own algorithms. Since more data processing and decision making can now be done by the analyzer, your system controller can devote more time to handling other measurement or processing tasks.

Customize functions with softkey programming

Softkey programming allows you to extend and customize the analyzer's function set. Using the command flow functions of the HP 8566B/68B (*REPEAT*, *UNTIL*, *IF*, *THEN*, *ELSE*, and *ENDIF*), you can create a complete measurement program or data-processing routine that can be executed as easily as the analyzer's built-in functions without the use of an external computer.

To define a softkey, you first determine the sequence of front-panel keystrokes needed to perform a given measurement. Then you load the corresponding key codes into the

analyzer's 16K bytes of RAM, using either the front-panel keys (for short routines) or the HP-IB (IEEE 488). Up to 999 softkey functions can be defined. The defined softkey sequence can be executed simply by pressing the proper front-panel keys or by entering a simple HP-IB command.

Make hard copies without a computer

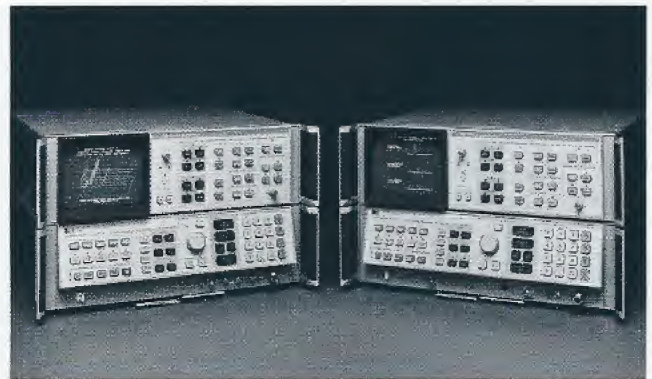
Included in the function set of the HP 8566B/68B is a routine that provides direct CRT transfer to an X-Y plotter. You can execute this function either from the front panel or by programming a routine using the HP-IB *PLOT* command.

Internal routines also make it possible to store and manipulate more than 10 traces. After they have been stored in memory, you can recall these traces in a convenient format and transfer them directly to a plotter without computer control.

Add new capabilities to your current model

Programs written for the HP 8566A or HP 8568A will run on the new models. The HP 85862A HPL Software Pac and the HP 85863A BASIC Software Library are also directly compatible. Current model users may add the new analyzer capabilities through a retrofitting process. For more information about retrofitting, contact your nearest HP Service Center.

The HP 8568B RF Spectrum Analyzer is priced at \$34,600. The HP 8566B Microwave Spectrum Analyzer is \$55,000. For information about the HP 8566B, check **B** on the HP Reply Card; check **C** for information about the HP 8568B.



The new HP 8568B RF (left) and HP 8566B Microwave (right) Spectrum Analyzers offer expanded built-in functions and powerful customizing capabilities for greater performance and efficiency.

New measurement-plotting system

(continued from page 1)

- **As an analog X-Y recorder:** Offers high-sensitivity, high-CMRR (common mode rejection ratio) inputs for X-Y or Y-T recording plus 41,000 calibrated voltage sensitivities with digital readout, annotation capability, and storage for one measurement setup. This means easy calibration to user units, elimination of the need to stock graph paper, multiple recording on a single page, and less time needed for setting up repeated experiments.
- **As a digital plotter:** Has six pens, automatic pen capping, and the powerful HP-GL (Hewlett-Packard Graphics Language) instruction set. These features provide minimal operator intervention, more colors to differentiate traces, and access to most programs written for other HP plotters. Output can be plotted on both B/A3-size (11 in × 17 in)

and A/A4-size (8.5 in × 11 in) paper and transparency film at a rate of up to 75 cm/s (29.5 ips).

- **As a data-acquisition component:** Can acquire and send data to a controller via the HP-IB (IEEE 488) at a streaming rate of up to 500 samples/s. The HP 7090A sends data in direct streams from the ADCs or the buffers and receives data from the controller to compare with a current measurement. With its programmable triggering, it allows iteration of measurements or checking for go/no-go conditions.

Easy-to-use software

The HP 7090A's software package makes all its functions accessible right from the start. The software is menu-driven, written in BASIC, and designed for use with HP Series 200 Computers. The software program includes setup, measurement annotation, data manipulation, screen display, hard-copy plotting, and storage and retrieval of measurement files.

The HP 7090A Measurement-Plotting System is priced at \$4,400, and the HP 17090A Measurement Graphics Software is \$700.

For more information, check **A** on the HP Reply Card.